CLIMATE NARRATIVE, September 2019 and as noted

WEST COAST OF UNITED STATES AND NORTH PACIFIC

During the final days of September 2019 **sea surface temperature** (SST_{Sp}) of 10°-12°C was found from Point Arena (39°N) to Cape Blanco (42.8°N), with a negative SST_{Sp} anomaly (≥-1.5°C). Eastern North Pacific (NP) negative SST_{Sp} anomaly was also seen offshore Southern California and northern Mexico and in the eastern equatorial Pacific. Elsewhere positive SST_{Sp} anomaly was typical of the Northeastern Pacific. Positive SST_{Sp} anomaly (1°-3°C) occurred along the US west coast north of 43°N (16°-19°C) and was continuous seaward to 180°E/W and into the Bering and Chukchi Seas. Neutral to positive SST_{Sp} anomaly was nearly continuous across the NP between 5°-25°N. Negative SST_{Sp} anomaly (occurred north of Japan between 170°E and 140°E. During September negative **sea level height anomaly** (SLA), occurred along the coast of North America to 40°N and across the NP to Indonesia and Thailand 0°-20°N, 120°-140°E. North of 20°N, the western NP had large areas of positive SLA to 25 centimeters. The central NP had large areas of positive SLA anomaly south of 20°N.
https://www.ospo.noaa.gov/Products/ocean/sst/anomaly/
https://coastwatch.pfeg.noaa.gov/elnino/coastal_conditions.html (current)
https://coastwatch.pfeg.noaa.gov https://climatereanalyzer.org/wx/DailySummary/#sstanom (current)
http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/ocean/weeklyenso_clim_81-10/wksl_anm.gif

NOAA VIIRS and other satellite imagery derived for the US west coast during September 2019 showed coastal bands, 30-100 km wide, of surface **chlorophyll-a** (chl-a) with concentration between 0.2-0.6 mg/m^3 along the coast of southern California and northern Mexico. Between 33° and 42°N filaments and eddies appeared to carry surface chl-a 300 to 500 km seaward. From 43-47°N, coastal bands of chl-a narrowed, but remained 0.5-4 mg/m^3 concentration. This coastal band joined with areas of similar concentration extending across the Gulf of Alaska and Bering Sea. Chl-a concentrations more than 5 mg/m^3 occurred near shore between San Francisco (37.7°N) and Point Conception (34.4°N) and off Vancouver Island (48°-51°N).
https://coastwatch.pfeg.noaa.gov/erddap/griddap/erdVHNchla8day.graph?chla[(2019-09-26T00:00:00Z)][(0.0)][(83.65125):(-0.10875)][(-193.76625):(-110.00625)]&.draw=surface&.vars=longitude%7Clatitude%7Cchla&.colorBar=%7C%7C%7C%7C%7C&.bgColor=0xffccccff
https://coastwatch.pfeg.noaa.gov/coastwatch/CWBrowserWW180.jsp#

September SST_{Sp} at Buoys

Offshore **Torrey Pines,** (46225) 32.9°N, 177.4°W at 549 m depth, the average SST during September 2019 (SST_{Sp}) was 22.5°C with extremes of 21°C and 25.2°C occurring on 30 and 2, 7 September, respectively. Average temperatures were 23.4, 22.3, 21.8°C for the first, second and final thirds of September, noted below as [23.4$_H$, 22.3, 21.8$_L$°C], and indicating the monthly third associated with High ($_H$) and Low SST_{Sp} ($_L$). At the **Santa Monica Basin** Buoy, 46025 at 33.8°N, 119.1°W, 33 nautical miles (NM) WSW of Santa Monica the final third of the month had SST_{Sp} of 21.7°C. The multi-year monthly average SST (SSTa) at 46025 is 19.8°C. **Santa Barbara Channel** Buoy, 46053 at 34.3°N, 119.9°W, SSTa and SST_{Sp} were 17.6 and 19.0 (16.5-21.1°C), respectively, with [18.5$_L$, 19.2$_H$, 19.3°C]. At the Harvest Buoy (46218), 34.5°N, 120.8°W, offshore **Point Conception** at 550 m depth, SST_{Sp} was 16.1 (12.1-19.4°C), with [16.8$_L$, 16.6$_H$, 14.9°C]

At the **San Francisco** Buoy (46026) 18 NM west of San Francisco (37.8°N, 122.8°W), SSTa and SST_{Sp} were both 14.4 (11.5-17.0°C), [14.6H,14.1L,14.4°C]. At the **Eel River** Buoy (46022) 17 NM WSW of Eureka, CA (40.7°N, 124.5°W) September SSTa and SST_{Sp} were 12.7°C and 15.6°C (10.6-18.8°C), respectively [16.7H 16.6, 13.4L°C]. At the **Tillamook Buoy** (46089), 85 nautical miles WNW of Tillamook, OR (46°N, 125.8°W), the SSTa and SST_{Sp} were 17.1°C and 18.8°C (16.9-20.4°C), respectively [19.3H, 18.9, 18.1L°C]. Near **Cape Elizabeth** (46041), 45 NM northwest of Aberdeen, WA (47.4°N,124.7°W) SSTa and SST_{Sp} were 13.5°C and 16.0°C (14.2-17.9°C), respectively [15.9LH, 16.2, 15.8°C]. **Neah Bay** Buoy (46087), 6 NM north of Cape Flattery (48.5°N,124.7°W), September SSTa and SST_{Sp} were 11.2° and 13.6°C (11.0-17.8°C), respectively [12.1L, 14.5LH,14.4°C]. SST is measured 0.4-1.0 m below the level sea surface, depending on buoy type. https://www.ndbc.noaa.gov/station_page.php?station=46087

Shore station temperature

The **La Jolla** (32.9°N) **SIO-Manual Shore** Station Program found SST_{Sp} at daily record highs (26°C) in early September with daily SST_{Sp} anomaly about 5°C. SST_{Sp} decreased to about 21.3°C, with daily anomaly 2-3°C at the end of September. Multi-year mean (SSTa) for September is 19.8°C. https://scripps.ucsd.edu/programs/shorestations/

La Jolla Subtidal Water Temperature (STWT), measured at fixed depth below the lowest tide at tide gauging stations, had September mean of 21.9°C, with range from 16.8 to 26.0 (16.8-26.0). Averages during the first, second and third 10-day July periods were 23.4, 21.6 and 20.7°C, respectively [23.4LH, 21.6L, 20.7L°C]. At the **Santa Monica** pier (34°N) September average STWT was 21.2°C (16.6-23.2°C), with [20.6L, 21.5, 21.6H °C]. In Southern **Monterey Bay** (36.6°N) average September STWT was 15.7°C (13.0-18.7°C), with [15.6H, 15.2L, 16.3°C]. **Arena Cove** (38.9°N) average STWT for September was 10.9°C (9.9-13.3°C), with [10.6, 11.1LH, 11.0°C]. **Crescent City** (41.7°N) average STWT was 14.8°C (10.9-18.2°C), with [16.1, 15.4H, 12.7L°C]. **Port Orford (**42.7°N) average STWT was 12.8°C (8.7- 16.2°C), with [14.0H, 13.6, 10.8L°C]. **Neah Bay** (48.4°N) September STWT average was 12.9° (9.4-17.0°C), with [10.8, 13.7H, 14.5L°C].
https://tidesandcurrents.noaa.gov/stations.html?type=Physical%20Oceanography

EQUITORIAL AND SOUTH PACIFIC (late September and as noted)

During early September, areas of negative **SST_{Sp}** anomaly (≥-2°C) increased across the Equatorial Pacific (EP), then decreased spatially through the month and persisted east of 135°W. Eastern EP upper 300-meter heat content anomaly was negative in early September, but trended positive at month's end. Subsurface temperature anomalies remained positive (≤2.5°C) in the central EP at 0-200m depth and negative above 100m in the east. Pacific-wide SST anomaly patterns of previous months persisted with positive SST_{Sp} anomaly more common in the North Pacific and negative SST_{Sp} anomaly more common in the South Pacific (SP). Neutral to negative SST_{Sp} anomaly (≥-1.5°C) occurred in the SP east of 120°W. Between 30°S and 10°N**, Sea level height anomaly** (SLA) was negative along the eastern Pacific boundary, extending west to 140°W in tropics. Positive SLA (≤15 cm) was seen in the central SP north of 20°S and to the west reaching 150°E between 10°S-10°N. Negative SLA anomaly (≥-10 cm) occurred off northern Australia and west of 150°E; this anomaly extended north to 20°N.
https://www.cpc.ncep.noaa.gov/products/analysis_monitoring/lanina/enso_evolution-status-fcsts-web.pdf

http://www.ospo.noaa.gov/Products/ocean/sst/anomaly/
http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/ocean/weeklyenso_clim_81-10/wksl_anm.gif

The NOAA **Oceanic El Niño Index** (ONI) (3-month running mean of SST anomalies in the Nino 3.4 region) continued to weaken with values of 0.5 for May-July (MJJ), 0.3 for JJA and 0.1 for JAS.
http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/lanina/enso_evolution-status-fcsts-web.pdf
https://climatedataguide.ucar.edu/climate-data/multivariate-enso-index (alternate index)

The September 2019 NOAA/NCEI **Pacific Decadal Oscillation Index** (PDO), calculated from ERSST.v4, was neutral (0.0). PDO and ONI indices are recalculated and may change initially as data are assimilated into the data base.
https://www.ncdc.noaa.gov/teleconnections/pdo/ , http://research.jisao.washington.edu/pdo/PDO.latest.txt

The **Pacific / North American Teleconnection Index** (PNA), computed from atmospheric pressure over the Pacific Ocean and North America had weakly positive daily values during September. https://www.cpc.ncep.noaa.gov/data/teledoc/pna.shtml (see computational alternatives) Near-neutral low values have been typical of **ONI, PDO, PNA** during the last several months.

September monthly ERD/SWFSC coastal **Upwelling Indices** (UI) show 45°-60°N with variable winds and increasing atmospheric low pressure influence typical of the season. Computations between 27°-39°N had positive UI (upwelling favorable conditions). At 36, 39 and 42°N UI was 42%, 63% and 47% greater, respectively, than multi-year monthly averages,. Daily UI calculations indicate favorable upwelling conditions at 39°N on 3-4, 13-14 and 20-28 September.
https://upwell.pfeg.noaa.gov/products/PFELData/upwell/monthly/table.1909
https://oceanwatch.pfeg.noaa.gov/products/PFELData/upwell/daily/p09dayac.all

PRECIPITATION and RUNOFF (late September**)**

Drought conditions eased from Oregon's north coast to SE Alaska. https://droughtmonitor.unl.edu. Central and Southern California have seen little precipitation since May and many stations are starting the new rainfall accounting year (beginning on 1 October) with small deficits from multi-year seasonal averages. Northern CA, OR and WA received 2-12 inches of rain during September and are starting the water year with surplus over multiyear seasonal averages. The **Fraser River**, measured at Hope (130 km upriver from Vancouver, B.C.), was flowing near 2,800 m^3/s (98,868 cubic feet /sec or cfs); September multi-year median for Hope is 1,850 m^3/s. https://wateroffice.ec.gc.ca The **Puyallup River** at Puyallup, WA was flowing at 1,450 cfs [1,429 historical median as cfs in brackets]. **Skagit River** flow was 10,000 [8,330 cfs] near Mount Vernon. **Stillaguamish River** discharge was 537 [418 cfs] at Arlington. **Columbia River** transport at the Dalles was 119,000 [103,000 cfs] and 85,600 cfs [109,000 cfs] at Vancouver WA (tidal influence). At Elkton, OR, the **Umpqua River** transport was 1,430 [1,150 cfs]. **Rogue River** flow was 1,930 [1,250 cfs] at Grants Pass and 2,260 [1,570 cfs] at Agnees. The **Klamath River** near Klamath, CA was transporting 3,230 [3,040 cfs]. Near Crescent City, **Smith River** discharge was 474 [252 cfs]. The **Eel River** at Scotia had 155 [106 cfs] transport. At the **Battle Creek,** Coleman National Fish Hatchery, the flow was 352 [248 cfs]. **Butte Creek** at Chico had 178 [113 cfs] transport. **Sacramento River** transport was 17,000 [11,300 cfs] at Verona and

17,100 [12,600 cfs] at Freeport. **San Joaquin River** flow was 3,980 [1,490 cfs] at Vernalis. **Pescadero Creek** transport was 4 [2 cfs] near Pescadero, CA, **San Lorenzo River** discharge was15 [7 cfs] at Santa Cruz. **Pajaro River** at Watsonville was flowing at 2 cfs. The **Salinas River** near Spreckels was not flowing [2 cfs]. The **Carmel River** at Carmel was flowing at 7 [0 cfs]. The **Big Sur River** near Big Sur, CA flow was 22 [14 cfs] (also see notes) https://waterdata.usgs.gov/ca/nwis/current/?type=flow
https://www.cnrfc.noaa.gov/awipsProducts/RNOWRKCLI.php= (current)
https://wateroffice.ec.gc.ca/search/real_time_results_e.html
https://www.cpc.ncep.noaa.gov/products/global_monitoring/precipitation/global_precip_accum.shtml

Notes

River discharge changes marine coastal environments. The chemical content and sediment load of river discharge, along with the tides, change flow fields as water density is redistributed at the coast. River discharge brings undissolved objects ranging in size from cubic meters to sub-micron scale sediment of anthropogenic and mineral origin. Hundreds of chemicals ranging from toxic to nutrient compounds arrive in river discharge. Each compound may have an extensive web of biological effects that may or may not be mitigated by natural processes. Heavy rains, though cleansing locally, wash fecal matter, oil (and hydrophobic compounds) and detritus into the coastal zone. River discharge is environmentally important at many scales.
https://pubs.usgs.gov/circ/circ1215/major_findings.htm
https://www.sfei.org/documents/understanding-microplastics https://www.ncbi.nlm.nih.gov/pubmed/29554567
https://eos.org/opinions/uncontrolled-chemical-releases-a-silent-growing-threat
kimberly.miner@main.edu john.wilkinson@york.ac.uk https://darrp.noaa.gov/hazardous-waste/hanford-nuclear-site
https://www.eurekalert.org/pub_releases/2019-05/uoy-afi052419.php
https://ca.water.usgs.gov/wildfires/wildfires-water-quality.html

Salmonid reproduction depends on natal river and ocean survival. At end of September 2019 Sockeye Salmon at, Bonneville Dam 235 km up the Columbia River were counted at 35% of last year (to date) and 20% of the to-date 10-year average of 319,966, abbreviated below as [35, 20% (319,966)], respectively. Steelhead were [83, 28% (370,907)], with the summer run 90-99% complete by 30 September. Coho Salmon were [180, 77% (71,160)]. Early run (spring and summer) Chinook Salmon were [71, 43% (248,693)]. Early Chinook runs are complete for 2019. Fall run Chinook were [145, 51% (487,419)]. On the lower Columbia River, the Fall Chinook run is generally 70-90% complete at the end of September. On the Fraser River, in southern Canada, an estimated 478,700 Sockeye and 8,375,000 pink salmon were measured acoustically and by test fishing during mid-September. Fraser River Sockeye are tracking below pre-season estimates and Pink Salmon runs appear more robust than anticipated.
http://www.fpc.org/web/apps/adultsalmon/R_yeartodatecomparisontable_results.php
https://www.psc.org/publications/fraser-panel-in-season-information/fraser-river-panel-regulatory-announcements/

This Narrative may be found,
https://coastwatch.pfeg.noaa.gov/elnino/coastal_conditions.html
Jerrold.G.Norton@noaa.gov Phone:831-648-9031